

VARIETIES OF *ASTRAGALUS PULSIFERAE*
(LEGUMINOSAE)

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ABSTRACT. Described as new is *Astragalus pulsiferae* var. *coronensis*. This new variety is distinguished by its superficial root crown and longer pod trichomes, as well as by more subtle differences in the type of internode pubescence. In addition, the stipules in the new variety are all distinct, correlating with the above-ground stem.

Key Words: *Astragalus*, new variety, taxonomy, California

Gray (1874) named *Astragalus pulsiferae*, ascribing it to “*Phaca, Inflatii*.” Subsequently a second plant, *A. suksdorfii*, was described by Howell (1893). Barneby (1958) treated the later-named plant at varietal rank within *A. pulsiferae*. The species as broadly interpreted by him (Barneby 1964: 965) is an “. . . enigmatically variable species with decidedly bladderly pods more often than not unilocular but sometimes provided with a rudimentary septum; its lower stipules vary from free to connate and its root-crown from superficial to buried.” Barneby (1964: 969) also noted:

“Occasional populations found in the same area [as var. *pulsiferae*], at least sometimes in stiffer soils, combine the characteristic vesture and calyx with a superficial root-crown and stipules all free to the base; samples from these, judged in isolation from the whole species, cannot be excluded on technical grounds from sect. *Inflatii*.”

From the 1964 tentative placement with sect. *Monoenses*, the species was realigned, in its entirety, to sect. *Humistrati* subsect.

Micromerii (Barneby 1984: 171), where it was compared to *A. tiehmii* Barneby. That placement was followed subsequently in the treatment of the Fabales in the *Intermountain Flora* (Barneby 1989), and tentatively by Welsh (unpubl. manuscript).

Plants with a superficial root crown but with spreading stem pubescence of var. *pulsiferae* were regarded, at least tentatively, by Barneby (1964: 972), who had seen the plants in the field and of which he had made a collection, as being products of habitat differences; “. . . but plants from stiffer soils, which are composed of sand compacted with basalt pebbles, have a superficial root-crown and stipules not or at least less strongly connate.” These latter plants, which Barneby included within var. *pulsiferae*, differ in other respects, also. The plants tend to be erect and tufted, not prostrate-reclining from where they protrude from the soil, and while they have the spreading or spreading-ascending pubescence on stems and petioles, the pod trichomes are decidedly longer than in those plants with a subterranean caudex. Additionally, the stipules in those plants with the superficial root crown are all distinct. Despite the differences, a part of which might still be related to different microhabitats, the relationship of the tufted versus prostrate plants is clearly evident.

Co-authors Ondricek and Clifton have studied the plants in the field for several seasons; Welsh made observations on some populations during June of 2001. These observations, added to those made by Barneby and to information derived from the examination of a rather more complete set of specimens at BRY, CAS, ORE, RSA, UC, and WTU from throughout the range of the species, give indication that there are at least three taxa in the *pulsiferae* complex, as discussed below. In addition to the representative specimens listed below, there are specimens of all three taxa at CHSC.

Astragalus pulsiferae A. Gray, Proc. Amer. Acad. 10: 69. 1874.

TYPE: U.S.A. California: Sierra and Plumas Cos., *Pulsifer-Ames & Lemmon s.n.* [LECTOTYPE designated by Barneby (1964: 972): California: Plumas Co., Aug 1874, *Pulsifer-Ames 33* GH!].

Perennial, caulescent, (4) 10–25 (30) cm long, from a branching subterranean (or nearly or quite superficial) caudex, the branches slender. Pubescence basifixed, strigose-strigulose, villos-hirsute, or villosulous. Stems slender, prostrate to decumbent

or erect or erect-ascending, buried for a space of (0) 2–9 cm. Leaves 1–4.5 (5.5) cm long; leaflets (3) 7–13, 2–12 mm long, 1–4 (4.8) mm wide, oblanceolate- or obovate-cuneate, retuse or truncate and more or less apiculate, almost flat to loosely folded, rather thinly villous below, less so above; stipules 1–4.5 (5) mm long, either all distinct or some of the buried ones connate. Peduncles 0.4–2.5 cm long, very slender, shorter than the leaf; racemes (2) 3–13 flowered, the flowers spreading at anthesis, the axis (2) 4–12 mm long in fruit; bracts 0.8–2.4 mm long; pedicels 0.7–1.8 mm long, disjointing in age; bracteoles 0; calyx 3.2–5.8 (6.2) mm long, the tube 1.3–2.6 mm long, shallowly campanulate, villous or villosulous, the teeth 1.4–3.6 mm long; flowers (5.2) 6–8.5 mm long, whitish, the banner lilac-veined and keel tipped with lilac, the banner abruptly recurved through 90–100°; ovules (3) 5–9. Pod spreading or declined (often humistrate), sessile, 8–20 mm long, (5) 6–11 (13) mm thick, bladderly-inflated, somewhat dorsiventrally compressed, half-ovoid or ovoid-ellipsoid, unilocular or subunilocular, strigulose to thinly villous, villosulous, or pilosulous.

The species is confined, except for an outlier in Klickitat County, Washington, to the adjacent Shasta, Lassen, Modoc, Plumas, and Sierra Counties, California, and Washoe County, Nevada.

KEY TO VARIETIES OF *ASTRAGALUS PULSIFERAE*

1. Caudex subterranean or less commonly superficial, the stems foliose only to ground level, the subterranean caudex branches lacking leaves; stems strigulose or villous to villous-hirsute; stipules all distinct or the lowermost connate around the stem; pods strigulose or hirtellous, the hairs 0.4–0.9 mm long (2)
2. Stem (at least distally), leaf-rachis, and peduncle villous or villous-hirsute with widely spreading or spreading-ascending hairs; stems subterranean for 6–10 cm
..... var. *pulsiferae*
2. Stem, leaf rachis, and peduncle strigose to loosely strigulose with ascending and subappressed, sinuous hairs; stems subterranean for (0) 1–2.5 (4) cm
..... var. *suksdorfii*

1. Caudex superficial, the stems foliose to the base; stems villosulous; stipules all distinct; pods villosulous, the hairs 1–1.7 mm long var. *coronensis*

Astragalus pulsiferae var. *pulsiferae*

Tragacantha pulsiferae (A. Gray) Kuntze, Rev. Gen. Pl. 947. 1891.

Phaca pulsiferae (A. Gray) Rydberg, N. Amer. Fl. 24: 357. 1929.

Plants with root crown commonly subterranean. Stems mostly buried for a space of (0) 2–9 cm, commonly branched at emergence from soil, the foliose internodes villous-hirsute. Calyx teeth (1) 1.4–3.6 mm long. Pod pubescence 0.6–0.9 mm long.

Flowering May to August. Loose sandy sites and interdune valleys, often with sagebrush, on the east side of the northern Sierra Nevada. Mostly on sand derived from weathered granitic rocks at 1310–1798 m in Lassen, Plumas, and Sierra Counties, California, and Washoe County, Nevada.

This variety has a rather narrow geographic distribution, from Sierra Valley (Plumas County) and Long Valley (Lassen and Sierra Counties), California, and generally due east about 16 km in Washoe County, Nevada (Antelope and Red Rock Valleys). The individual plants appear as tufts arranged in a circle around a central area filled level with sand. This circular pattern is not evident at sites where the plants are in competition with *Bromus tectorum* L. The tufts arise from the ends of prostrate, subterranean, naked caudex branches, which arise from a central, deeply set taproot. The longest hairs (these spreading or spreading-ascending) of stems and foliage are more than 0.7 mm long, and with pod hairs less than 1 mm long.

REPRESENTATIVE SPECIMENS: California: Lassen Co., ca. $\frac{3}{4}$ mi. SW of Hallelujah Junction, 2 Jul 1999, *Ondricek-Fallscheer 195* (BRY); Beckwourth Pass (E side), 19 Jul 1955, *Howell 30,818* (ORE); Plumas Co., ca. 8 mi. ESE of Frenchman Lake and 3 mi. due NE of Beckwourth, 8 Jul 1999, *Ondricek-Fallscheer 197* (BRY); Beckwourth Pass, W side, 13 Jun 2001, *Welsh & Atwood 28,120* (BRY); Beckwourth Pass, 19 Jul 1955, *Rose 55,152* (BRY); Sierra Co., Long Valley, 1874, *Lemmon 515* (photo at JEPS). Nevada: Washoe Co., Red Rock Valley, 21 mi. N of Red Rock exit from Reno, 1 Jun 1982, *Lavin, Williams & Barneby 4125* (BRY).

Astragalus pulsiferae var. *suksdorfii* (Howell) Barneby, *Aliso* 4: 131. 1958.

Astragalus suksdorfii Howell, *Erythea* 1: 111. 1893. TYPE: Washington: Falcon Valley, 3 Jun, 21 Jul 1883, *Suksdorf* [LECTOTYPE designated

by Barneby (1964: 971): 3 Jun 1883, *Suksdorf 481* ORE!; ISOTYPES: GH!, NY!, US, WS].

Phaca suksdorfii (Howell) Piper, Contr. U.S. Natl. Herb. 11: 369. 1906.

Plants with caudex commonly subterranean for (0.5) 1.5–2.5 cm, or the caudex rarely exactly superficial. Stems mostly simple, sometimes branched or spurred at 1 or 2 nodes preceding the first peduncle, the foliose internodes strigose-strigulose. Calyx teeth 1.4–2.5 mm long, subequal to the tube. Pod pubescence 0.4–0.7 mm long.

Flowering May to July. Open pine forest in loose volcanic substrates at 1380–2005 m, in northwest Plumas and adjacent Lassen and Shasta Counties, California, and also in Falcon Valley, Klickitat County, Washington, at approximately 605 m.

Materials from the main body of the variety in northeastern California tend to average smaller, especially in overall stature (7–10 vs. 20–33 cm tall) and leaf (1.3–2 vs. 3.5–4.7 cm) and leaflet size (1.5–5 vs. 4–12 mm; and the leaflets are more definitely conduplicate) than those in the disjunct type locality in Klickitat County, Washington. Additionally, the California representatives appear to have a more definitely subterranean caudex than those from Washington. The size of the vegetative parts appears to be definitive. However, the floral measurements appear to be identical, and the pod size seems to form a continuum. The difference in size between the disjunct plants in Washington versus those in California within var. *suksdorfii* is matched by a similar size range within individuals of var. *pulsiferae*, a main difference being the geographic disjunction of specimens from the type locality of var. *suksdorfii* in Washington and the body of the variety in northern California. The species is evidently missing in Oregon. Despite qualitative differences, it seems best at the present to maintain both of the morphological variants from Washington and California within the concept of var. *suksdorfii*.

REPRESENTATIVE SPECIMENS: California: Lassen Co., ca. 6.5 mi. W of Crater Mt. and 7.5 mi. due ENE of Lassen Volcanic National Park, 14 Jul 1999, *Ondricek-Fallscheer 205* (BRY); Plumas Co., gravelly plain about the airfield west of Chester, 22 Jun 1938, *Heller s.n.* (RSA); Shasta Co., Bunchgrass Valley, 6 Aug 1911, *Eggleston 7531* (NY); Bunchgrass Valley, 6 mi. due N of jct. Hwy. 44 and 89 (jct. is near NW corner of Lassen Volcanic National Park), 14 Jul 1999, *Ondricek-Fallscheer 202* (BRY). Washington: Klickitat Co., W of Conboy Lake National Wildlife Refuge, 7 Jul 2000, *Ondricek-Fallscheer 208* (BRY); Falcon Valley, 16 Jul 1908, *Suksdorf 6293* (ORE).

Astragalus pulsiferae* var. *coronensis Welsh, Ondricek & Clifton, *var. nov.* TYPE: California. Lassen Co., E of Hwy. 395, rd. to Rams Horn Spring Campground, 40°41.500'N, 120°16.931'W, silty sand, in juniper, sagebrush, and *Purshia* community, at 1540 m (5050 ft.), 14 Jun 2001, *Welsh & Atwood 28,158* (HOLOTYPE: BRY; ISOTYPES: CAS, ISC, NY, POM, UC, and others to be distributed). Figure 1.

Similis *var. pulsifera* et *var. suksdorfo* in habitu generali sed in caudicibus superficialibus internodiis villosulosis et pilorum leguminibus longioribus differt.

Plants with root crown superficial. Stems branching at soil level, foliose to the base, the internodes villosulous. Calyx teeth 1.5–2.5 mm long. Pod pubescence 1–1.7 mm long.

The new variety is named for the type locality near the Rams Horn Spring campground, the Latin *corona* being one possible translation of “horn.” Plants appear as low tufts, with no hint of a subterranean caudex. The branches arise from the root crown where it emerges from the soil. The presence of the superficial caudex, a subtle difference in internode pubescence, and definitely longer pod hairs are evidently diagnostic. Perhaps of less importance are the free stipules in this variety. Union of lowermost stipules in plants with a subterranean caudex is a common condition.

HABITAT, DISTRIBUTION, AND PHENOLOGY. *Astragalus pulsiferae* var. *coronensis* flowers May through July, and is found growing in sandy silt, friable at the surface, hard-packed beneath, among basalt cobble and gravel with juniper, sagebrush, bitterbrush, and Jeffrey pine at 1345–1890 m. Plants of *var. coronensis* grow on the Modoc Plateau in Modoc and Lassen Counties and on volcanic inclusions in the Sierra Nevada Range in Plumas County, California. It is evidently rare in Washoe County, Nevada, approximately 30 mi. (ca 42 km) east of the California border.

Discussion by Barneby (1964: 969) of the racial subunits of this complex species aggregation is pertinent. After delimiting the typical phase of the species, he points to “Occasional populations found in the same area, at least sometimes in stiffer soils, combine the characteristic vesture and calyx with a superficial root-crown

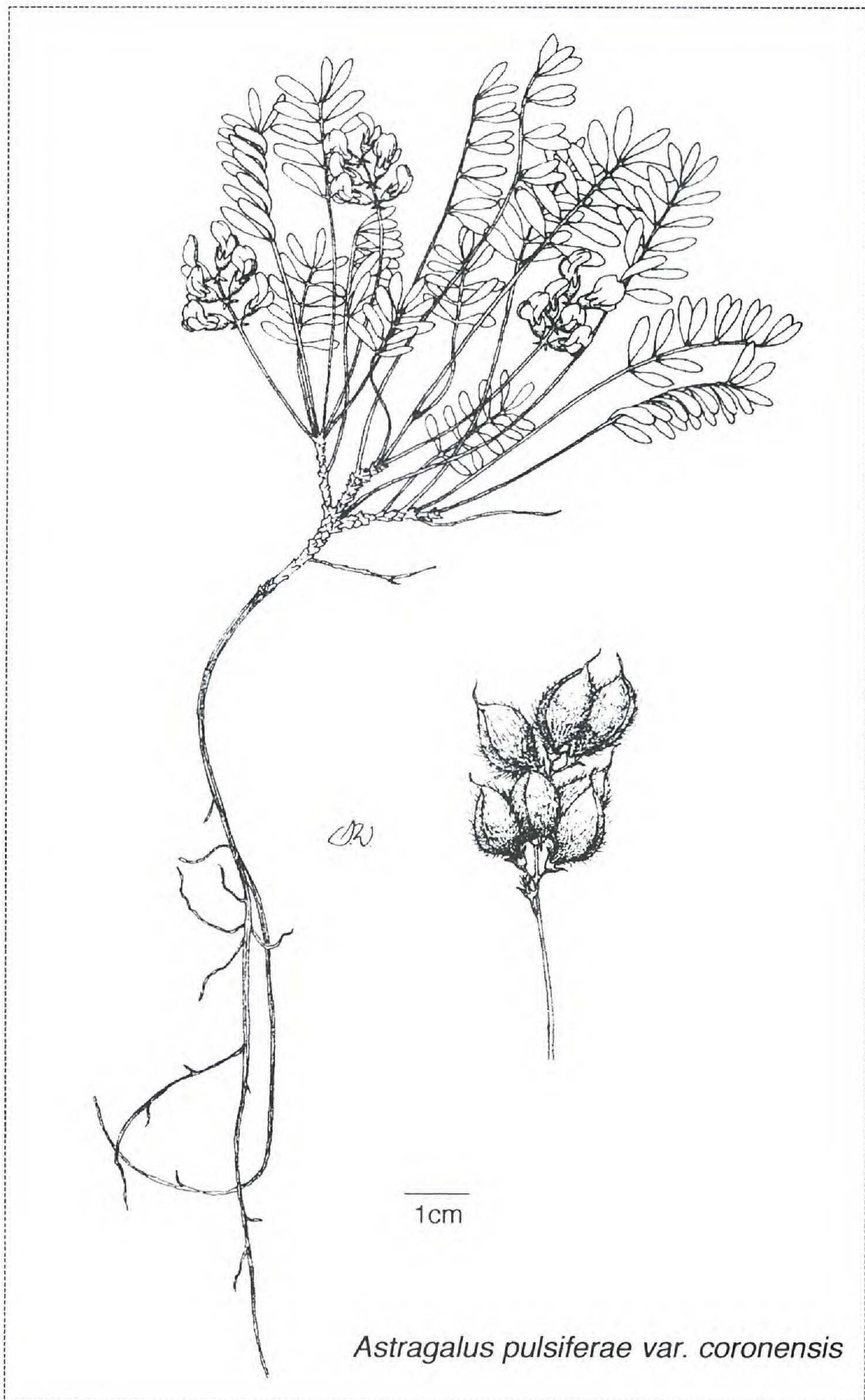


Figure 1. *Astragalus pulsiferae* var. *coronensis*. Plant drawn from *Ondricek-Fallscheer* 200 (BRY); fruits drawn from *Holmgren & Holmgren* 9500 (BRY).

and stipules all free to the base. . . ” The presence of connate stipules has been thought useful not only as a diagnostic tool, but as an indicator of relationships. Perhaps connation is at least partly in response, however, to the subterranean habit, an adaptation that allows overwintering of the plant below ground and survival in times of water stress. Whether this taxon would maintain its superficial caudex and distinct stipules in more friable substrates is not known; the microhabitat of var. *coronensis* is on stiffer substrates. All of the plants of var. *coronensis* lack the elongate caudex branches characteristic of the other two varieties, although those varieties occasionally have the caudex branches greatly shortened. The plants of var. *coronensis* appear as small tufts with the humistrate, pink-suffused pods arranged crown-like around the periphery. They are never ring-like around a patch of sand obscuring the buried taproot and caudex branches as in the other varieties.

ADDITIONAL SPECIMENS EXAMINED (PARATYPES): California: Lassen Co., Observation Peak, S side of mountain, 18 km (11 mi.) airline distance E of Ravendale, T34N R16E S34, 1890 m (6200 ft.) elev., 4 Jul 1980, *Holmgren & Holmgren 9500* (BRY); ca. 27 mi. due NE of Susanville, ca. 9 mi. due SSE of Ravendale, 0.5 mi. due NW of Rye Patch Spring, ca. 0.5 mi. E of Hwy. 395, N side of Ramhorn Springs Campground Rd., T33N R15E S28, 9 Jul 1999, *Ondricek-Fallscheer 199* (BRY); ca. 11 mi. due SE of Adin, E edge of Hunsinger Flat Road (U.S.F.S. Rd. 38N04), 1 mi. S of jct. with U.S.F.S. Rd. 39N08, T38N R10E S35, 9 Jul 1999, *Ondricek-Fallscheer 200* (BRY); E of Hwy. 395, rd. to Rams Horn Spring Campground, 40°41.54'N, 120°16.870'W, sandy silt, in juniper, sagebrush, and *Poa* community, 1541 m (5053 ft.), 14 Jun 2001, *Welsh & Atwood 28,150* (BRY); Modoc Co., S of Alturas, near Jones Lane, T41N R12E S16, 12 May 1981, *Schoolcraft 385* (NY); 2 mi. S of Yankee Jim Ranch, 1 Jul 1981, *Ganio 5* (NY); Plumas Co., E end of Squaw Valley and W end of Dixie Valley, 30 May 1998, *Clifton 36,000* (BRY). Nevada: Washoe Co., Granite Range, Leadville Canyon, T37N R23E S22, 30 Jun 1983, *Tiehm 8015* (CAS, NY, RSA).

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